



# Enabling User Provided Kernels in Amazon EC2

Version 1.01

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AWS is pleased to announce that customers can now run user provided kernels in EC2.

## Enablement

Amazon now allows you to load a para-virtual Linux kernel within an AMI or Amazon EBS volume. Thus, you have the option of creating images that contain a kernel and initrd, and behave closer to traditional virtual or physical machines. By enabling you to boot from the kernel within volumes, you can now seamlessly upgrade the kernel on Amazon EBS-backed instances.

## PVGrub: A New AKI

User provided kernels are implemented via *PVGrub*. PVGrub is basically a para-virtual “mini-OS” that runs a version of GNU GRUB, the standard Linux boot loader.

PVGrub operates similar to a bare-metal version of GRUB by reading `/boot/grub/menu.lst`. Further, PVGrub doesn't require *any* GRUB components to be installed on the disk.

Amazon has provided the following 32- and 64-bit Amazon Kernel Images (AKIs) for PVGrub:

aki-4c7d9525	ec2-public-images/pv-grub-hd00-V1.01-i386.gz.manifest.xml
aki-4e7d9527	ec2-public-images/pv-grub-hd00-V1.01-x86_64.gz.manifest.xml
aki-407d9529	ec2-public-images/pv-grub-hd0-V1.01-i386.gz.manifest.xml
aki-427d952b	ec2-public-images/pv-grub-hd0-V1.01-x86_64.gz.manifest.xml
aki-47eec433	ec2-public-images-eu/pv-grub-hd00-V1.01-i386.gz.manifest.xml
aki-41eec435	ec2-public-images-eu/pv-grub-hd00-V1.01-x86_64.gz.manifest.xml
aki-4deec439	ec2-public-images-eu/pv-grub-hd0-V1.01-i386.gz.manifest.xml
aki-4feec43b	ec2-public-images-eu/pv-grub-hd0-V1.01-x86_64.gz.manifest.xml
aki-6fd5aa3d	ec2-public-images-ap-southeast-1/pv-grub-hd00-V1.01-i386.gz.manifest.xml
aki-6dd5aa3f	ec2-public-images-ap-southeast-1/pv-grub-hd00-V1.01-x86_64.gz.manifest.xml
aki-13d5aa41	ec2-public-images-ap-southeast-1/pv-grub-hd0-V1.01-i386.gz.manifest.xml
aki-11d5aa43	ec2-public-images-ap-southeast-1/pv-grub-hd0-V1.01-x86_64.gz.manifest.xml
aki-9da0f1d8	ec2-public-images-us-west-1/pv-grub-hd00-V1.01-i386.gz.manifest.xml
aki-9fa0f1da	ec2-public-images-us-west-1/pv-grub-hd00-V1.01-x86_64.gz.manifest.xml
aki-99a0f1dc	ec2-public-images-us-west-1/pv-grub-hd0-V1.01-i386.gz.manifest.xml
aki-9ba0f1de	ec2-public-images-us-west-1/pv-grub-hd0-V1.01-x86_64.gz.manifest.xml



## Quick Start

Follow these easy tasks to get started right away.

1. Install an EC2 compatible kernel.
2. Generate an `initrd`.
3. Populate `/boot/grub/menu.lst`.
4. For new AMIs or Amazon EBS volumes, bundle, upload and register.
5. Launch an instance with the appropriate AKI.

## AKI IDs

AWS provides four PVGrub AKIs: two for each architecture type and based on hard disk layout. For traditional AMIs, use the "hd0" option, whereas those using Amazon EBS (i.e. where there is a partition within the image), use "hd0,0".

## Kernels

There are a number of Linux distributions that have compatible EC2 kernels. Some vendor kernels don't start reliably within EC2. The following is a *brief, non-comprehensive list* of kernels that we have tested or have vendor support:

- Fedora 8-12 Xen kernels
- SLES/openSUSE 10.x, 11.0, 11.1 Xen
- SLES/openSUSE 11.x EC2 Variant
- Ubuntu EC2 Variant kernels
- RHEL 5.x kernels
- CentOS 5.x kernels

## Frequently Asked Questions

### ***How do I create an AMI that uses PVGrub?***

When you create your AMI disk image, simply install the appropriate kernel package. Some distributions have a specific EC2 kernel; if a kernel is indicated, you will need to install that kernel. Also, some distributions won't update `/boot/grub/menu.lst` unless the GRUB package is installed. We recommend that you install the GRUB package first.

### ***How do I update an AMI to use PVGrub?***

You can choose either of two options:

- Option 1: Re-launch your AMI with the new kernel and make a RAM disk.



- Option 2: Boot the AMI that you want to update. Install a kernel (make sure you make the RAM disk) and create a new AMI from it.

## **GRUB Configuration**

For PVGrub to work, there must be a GRUB menu.lst configuration file present. Although GRUB itself doesn't have to be installed, its presence won't cause any problems either.

For most distributions, you have a couple of options for the GRUB configuration:

- Option 1: Install GRUB and allow the default kernel installation scripts to handle the installation and updating the GRUB configuration.
- Options 2: Populate a general /boot/grub/menu.lst. For example:

```
Default 0
Timeout 3
Fallback 1

title Vanilla EC2 Kernel 2.6.32.10
    root (hd0,0)
    kernel /boot/vmlinuz-2.6.32.10-ACME_SYS_EC2 root=/dev/sda1
    initrd /boot/initrd-2.6.32.10-ACME_SYS_EC2

title Ubuntu EC2 2.6.32.302-EC
    root (hd0,0)
    kernel /boot/ubuntu-ec2 root=/dev/sda1
    initrd /boot/initrd-ec2
```

We recommend Option 2 to control the kernel booting for a couple reasons. First, EC2 users don't have interactive control over the boot process; since there is no keyboard access, GRUB will proceed without user interaction. Secondly, and most importantly for Amazon EBS backed images, you want to protect against distributions that auto-update the kernel from breaking your image. By not relying on the auto-update mechanism and explicitly choosing which kernel you run, you reduce the risk of an incompatible kernel becoming the default kernel.

A fallback kernel isn't required, but is recommended when testing new kernels. GRUB can fall back to another kernel in the event that the new kernel fails. As mentioned earlier, however, since there is no keyboard access, having a fallback kernel allows the instance to boot even if the new kernel isn't found.

**Important:** A fallback kernel will not protect against launching a valid, but incompatible kernel.

### ***What about auto-updating the kernel?***

Since some Linux distributions have incompatible EC2 kernels, we strongly recommend that you disable automatic kernel updates. Please see the important warning in the *GRUB Configuration* section.

### ***What are the kernel limitations?***



Some Linux distributions don't provide EC2 compatible kernels. The previous list of known good kernels isn't comprehensive and we are working with vendors to enable more vendor kernels. Unfortunately, it isn't possible to support every kernel that is or can be compiled. In the event that a kernel doesn't work consistently or at all, we recommend you use a known good kernel or seek support from the vendor.

### ***What are the limitations of PVGrub?***

Since PVGrub is a paravirtual version of GRUB 0.97, it has all the limitations of GRUB. To use LVM with Amazon EBS volumes, you need a separate boot partition. Supported /boot file systems that PVGrub can boot from are:

- EXT2/3/4
- XFS
- ReiserFS

**Note:** These are the /boot file systems that we have tested and verified. Others could boot from PVGrub, but haven't been tested.

### ***What is supported in PVGrub?***

Although Amazon supports PVGrub, user provided kernels are not. If you have trouble loading a kernel, you should consult with the vendor or the Amazon EC2 forums. Unfortunately, due to the wide and varied kernel landscape, it is impossible for Amazon to provide support for all kernel variety.

### ***Whoops.....***

In the event that the kernel fails, you can boot the instance using a different AKI/ARI.